

R E P O R T R E S U M E S

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PLANNING GUIDE FOR 2500 MEGACYCLE INSTRUCTIONAL TELEVISION SERVICE.

MICRO-LINK SYSTEMS, COPIAGUE, N.Y.

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THIS BULLETIN IS A GUIDE FOR EDUCATIONAL INSTITUTIONS WHICH ARE PLANNING INSTRUCTIONAL TELEVISION STATIONS OR NETWORKS. STEPS ARE OUTLINED FOR PLANNING AND INSTALLING AN ITV SYSTEM. THREE EXAMPLES ARE GIVEN FOR SYSTEMS OF VARYING LEVELS OF COMPLEXITY. THIS IS NOT A DO-IT-YOURSELF GUIDE, BUT AN OUTLINE OF THE MAJOR ELEMENTS OF A SYSTEM IN TIME SEQUENCE REQUIRING CLOSE COORDINATION BETWEEN THE EDUCATOR AND THE CONTRACTOR. COMMENTS ARE MADE ON THE PROJECT MANAGER CONCEPT AND DIAGRAMS AND ILLUSTRATIONS OF EQUIPMENT ARE INCLUDED.
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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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PLANNING GUIDE
FOR 2500 MEGACYCLE
INSTRUCTIONAL TELEVISION SERVICE

This bulletin is a guide for educational institutions which are planning Instructional Television stations or networks. It outlines the steps required to plan and install an ITV system. Three examples are given for systems of varying levels of complexity. This is not a do-it-yourself guide, but rather an outline of the major elements of a system in time sequence. These several elements require close coordination between the educator and the contractor. Comments are made on the Project Manager concept.

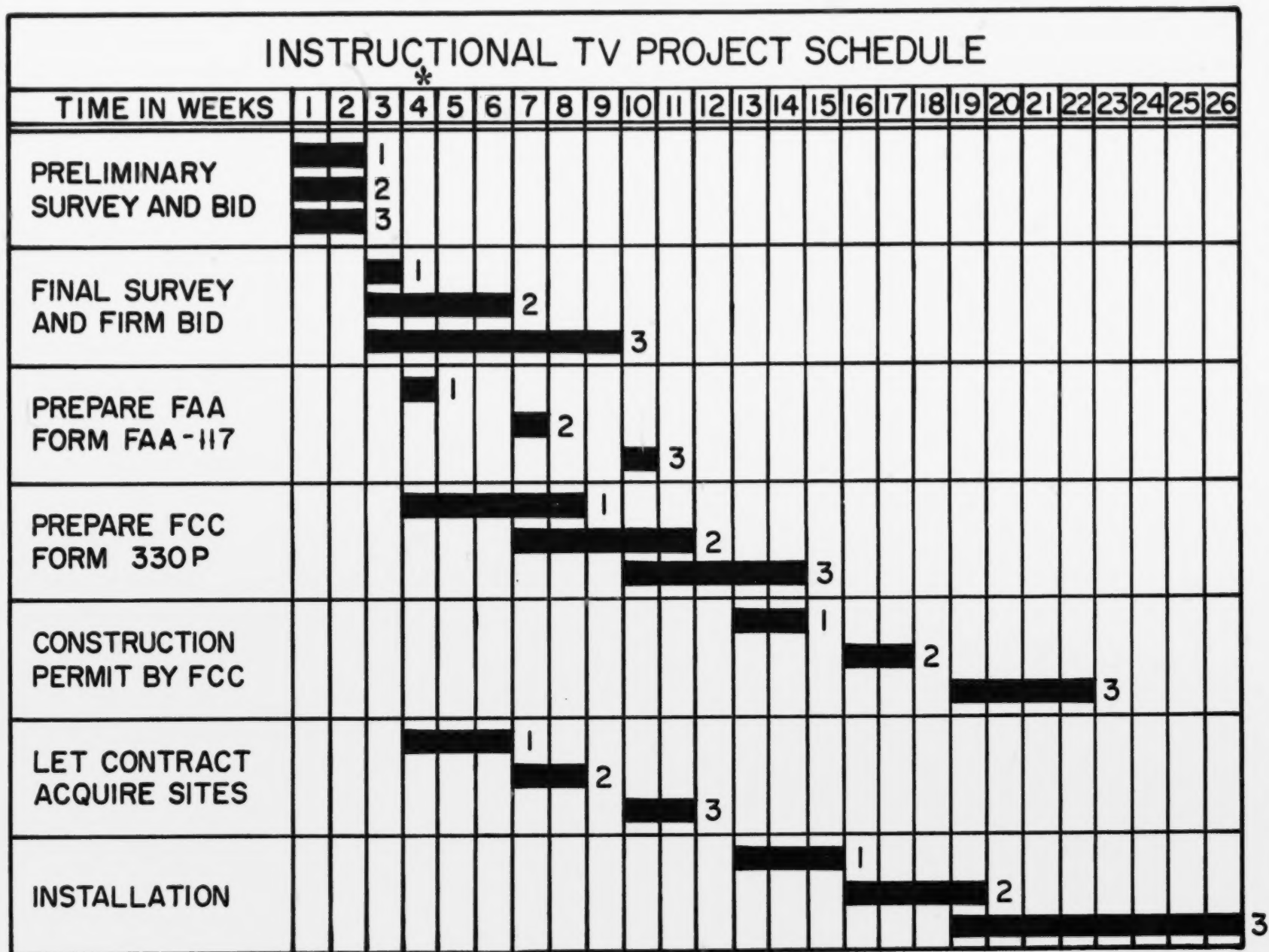


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* Lines marked 1, 2 and 3 are examples of ITV Systems of three different levels of complexity for illustrative purposes.

2500 MC Instructional TV Service

This new service is a microwave communication medium authorized by the Federal Communications Commission for the transmission of television signals for educational purposes. It is a special form of transmission capable of distribution of TV in a private, locally controlled closed circuit. 2500 Megacycle ITV makes possible the linking of many buildings within a school district or college campus without the cost and technical problems inherent to cable-connected systems. It is available to all educational activities - public, private, commercial or industrial. With this medium, TV programs originating live or from film or video tape may be transmitted. This bulletin is a guide for institutions planning their own systems.

Project Manager Concept

From the large and complex systems of the aerospace industry, there has developed a management technique called the Project Manager concept. This technique is very useful in managing a project involving many different fields of knowledge, and requiring the integration of many events in proper time sequence to reach the desired objective. This approach will be very useful in the planning and building of ITV systems. In its usual form the concept includes the best features of both individual authority, responsibility and committee action. An individual is delegated as project manager with sufficient authority and responsibility to see the project through to completion. A team of interested persons possessing the necessary special knowledge and skills is formed to give guidance to the project manager and as a means of efficient communication. In the case of ITV, both the user and the contractor should have a project manager. The team for the educator may include the Superintendent, Business Administrator, Attorney, Audio-Visual Director, Buildings Supervisor, and, in the case of new construction, the Architect. The contractor will use the project manager to negotiate technical details with the educator, administer any subcontracts, coordinate the activities of the factory and subcontractors and supervise installation and training of school personnel.

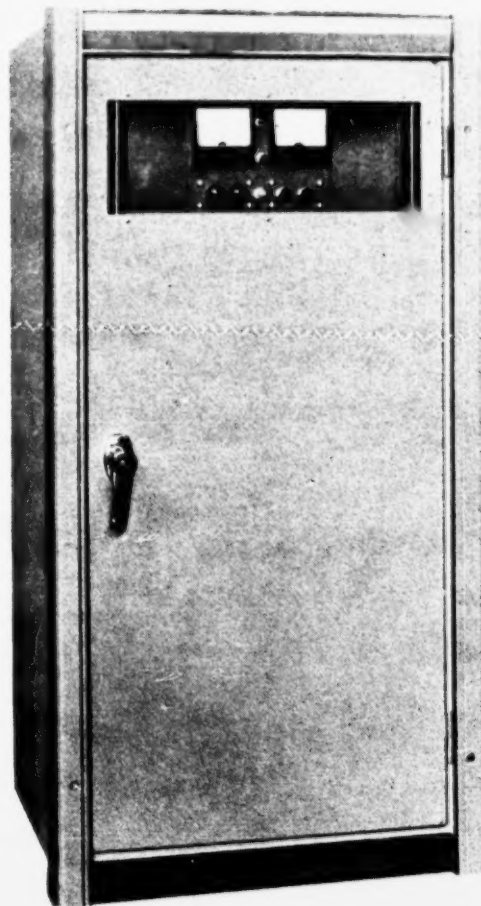
Project Schedule

The accompanying graph illustrates the major steps and the elapsed time required to install an ITV system. Three examples are given. The first example is for a typical compact school district in a heavily populated suburban area of generally flat terrain. The second example is one of increasing difficulty in



21 db two-foot parabolic 2500 megacycle receiving antenna with weather guard, including converter and power supply.

M O D E L #ME-1A T R A N S M I T T E R



The #ME-1A Instructional Television Transmitter is designed to meet the requirements of the Rules and Regulations of the Federal Communications Commission as set forth in Sub Part I of Part 74 with provisions for both attended and remote control operation. The transmitter can be easily modified for multi-channel operation.

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MODEL #ME-1A TRANSMITTER

Technical Specifications

Rated Carrier Power: Visual: 10 watts peak; Aural: 1 watt RMS

Frequency Range: 2500 to 2686 mc/sec

Emission: Visual: A5 Aural: F3

Frequency Control: Quartz crystal in temperature controlled oven

Frequency Stability: Visual: ± 50 KC Accuracy 5×10^{-6} Stability
Aural: 4.5 mc/s ± 1 kc/s higher than visual carrier

Antenna Coupling: Designed to operate into 50 ohm unbalanced transmission lines with a VSWR of less than 1.7:1

Input: Visual: .7 to 1.5 volts peak-to-peak composite signal 75 ohms unbalanced.
Aural: -10 to +10 dbm, 600 ohms unbalanced or balanced.

Carrier Control: Transmitter may be operated with visual, aural, or both carriers simultaneously.

Auxiliary Output: The transmitter can provide a separate composite visual and aural carrier output on any standard VHF channel number 7 through 13 inclusive at a level sufficient to drive most distribution systems.

Remote Control: The transmitter is designed for remote operation.

Reliability: All circuits are solid state with the exception of the Power Amplifier Stage. This Stage has a life expectancy in the excess of 5 years of normal use. (40 hours per week)

Power Source: 105 to 125 volts, 50 to 60 cycle AC

Monitoring: The transmitter is provided with a detected output after final stage for modulation monitoring.

Safety Features: Entrance doors are equipped with interlock switches which automatically disconnect all high voltage supplies. The final stage is provided with overload and antenna VSWR protection circuits. All other circuits are protected by suitable circuit breakers.

Mechanical Construction: The housing cabinet is fabricated of heavy gauge steel, welded, primed and finished in blue wrinkle enamel.
All doors are provided with locks to prevent unauthorized tampering.
Forced air cabinet circulation with dust and insect filter insure cool and dust-free operation.

which natural terrain or other obstacles, or greater range, complicate the design of the system. A still more complex example is the third system which could represent an urban or regional network containing a large number of receiving stations and several transmitting channels. The examples given represent the minimum time sequence which can be realistically achieved. No mention is made of the financial aspect; this element is assumed to be settled before the project begins. It will be shown that the three examples cited will require between three and six months to complete the project. Very large systems will require even more time.

Preliminary Survey and Bid

In this stage the school contacts the equipment manufacturer and describes its objectives, and the manufacturer will ask for information about the location of the desired transmitting and receiving sites, existing facilities, available maps and other data. The manufacturer will visit the school sites and make a preliminary evaluation of the technical problems. From the information obtained, a preliminary proposal and budgetary bid will be prepared. This activity is part of the manufacturer's sales effort and the educator incurs no obligation.

Final Survey and Firm Bid

This item varies considerably with the complexity of the system, and in some cases may involve the expenditure of money by the educator. If this is necessary, it will be included as an item of the manufacturer's preliminary proposal. For simple systems such as the first example, it is possible that the survey can be made at no cost. This survey involves the examination of topographical maps and other information and visits to the sites to ascertain the location of obstacles and natural terrain. This is necessary in order to establish the height of antenna towers and the location of repeater transmitters if necessary. In the case of very difficult situations such as urban areas, it may be necessary to resort to aerial photography in order to locate buildings and other manmade obstacles which do not appear on topographical maps. This last method involves some expense and time. As shown in the schedule chart, the final survey may require as little as one week but could extend to several weeks. It is possible that an individual project may take considerably more time. After the survey is completed, the manufacturer can then offer a firm price for equipment.

Prepare Form FAA-117

This form is required by the Federal Aviation Agency to

report the location of any structures which may be a hazard to air navigation safety. Any antenna mast which extends 20 feet or more above the highest point of an existing building must be reported. This information cannot be generated until the final survey is completed. The FAA issues no permits as such, but will comment usually within 30 days if it has objections. It is therefore a good idea to submit the form at the same time or in advance of the FCC 330P. Systems which do not require high antennas, or which use existing towers, do not require submission of the FAA form.

FCC Form 330P

This is the form that the Federal Communications Commission requires for application for a construction permit. It requires information on the financial and legal qualifications of the applicant, the intended program material, technical information on the equipment to be used and the location of transmitter and receiver sites. Several exhibits are required including maps and elevation drawings of each site. The completion of the form is a joint effort of the school and the manufacturer since each must contribute a portion of the required information. Legal representation is not necessary but is strongly recommended in order to expedite handling of the application. Most communications equipment manufacturers retain attorneys in Washington for representation before the FCC Commission.

The Commission is quite specific in its requirements and will consider only applications from institutions having a definite program in mind; it is not possible to simply apply for allocation of channel assignments for some vague future project. The Form requires a statement of the source of funds and the authority by which funds are obligated. Therefore, the applicant must be committed to a definite program at the time of application. The application requires specific information about the equipment to be used, thus the applicant must have established a definite project. Cost information is required, hence the applicant should have formed a contract or obtained firm quotations. Since the required data is specific, the earliest date on which the form can be prepared is the completion of the final survey. Minor changes in a system can be made after receipt of the construction permit, but details of transmitter location and installation should be firm.

Construction Permit by FCC

FCC procedures require that an application must be on file

for at least 30 days before a permit can be granted. This time is allowed for the purpose of hearing objections from interested parties or possible interference. After this waiting period has expired, the application is processed; it is difficult to estimate how long individual applications may take, but the chart shows a period of two weeks for the first two examples and four weeks for the third example (due to greater complexity.) Individual applications may take significantly longer, especially if the Commission receives a heavy volume of applications.

The Construction Permit allows the applicant to start installation of transmission and receiving equipment. It requires that construction begin within 60 days, and be completed within six months of the date of issuance of the permit. This period can be extended if the applicant can show good cause for any delays. In this way the Commission protects the public against tying up available channels which are not being used.

Let Contracts, Acquire Sites

Up to this point, all of the steps outlined must occur in the sequence described leading up to the issuance of the Construction Permit. As shown on the chart, this time sequence may extend from three to five months. In a given situation there may be a multiplicity of contracts, and there are other parties (FAA, FCC and the public) with an interest in the project. It is possible that a single contract could be made for a given project, but it may contain many "ifs, ands and buts". As an ~~alternate to a single contract~~ for the entire project, several separate contracts may be formed. As an example the final survey could be contracted with either the manufacturer or an independent consulting engineer. The survey, and the resulting system proposal, would be valid regardless of which company's equipment might be selected, but the equipment manufacturer would usually want to review the survey. If the survey shows that additional sites are necessary for remotely operated transmitters, then arrangements must be made to purchase, lease or otherwise obtain rights to install equipment at these sites. The selection of desirable sites and feasible alternatives would be considered in the final survey.

Where there are no existing facilities, it will be necessary to form either contracts or subcontracts for construction of studios, TV cameras, distribution systems, classroom receivers, and the like. In cases where the school forms a single contract with a manufacturer, then the manufacturer needs time to negotiate subcontracts with suppliers of other equipment and for construction of antenna towers if required. Another consideration

is that the manufacturer requires some lead time to prepare equipment for shipment to the site. Although equipment design is standardized, there are often minor adjustments or modifications which must be made for specific systems. Where changes are minor, the manufacturer can usually deliver equipment to the site within 30 days.

The earliest date at which a contract could be formed would be following completion of the final survey and establishment of firm prices, and the latest would be six to eight weeks prior to the expected date for granting of the Construction Permit. This is not the most desirable type of contract because there would need to be a number of "strings" attached to protect both parties against the possibility that the Construction Permit may be denied and that suitable sites may not be available. A safer course would be to wait until the Construction Permit is granted, but this would extend the time required to get "on the air".

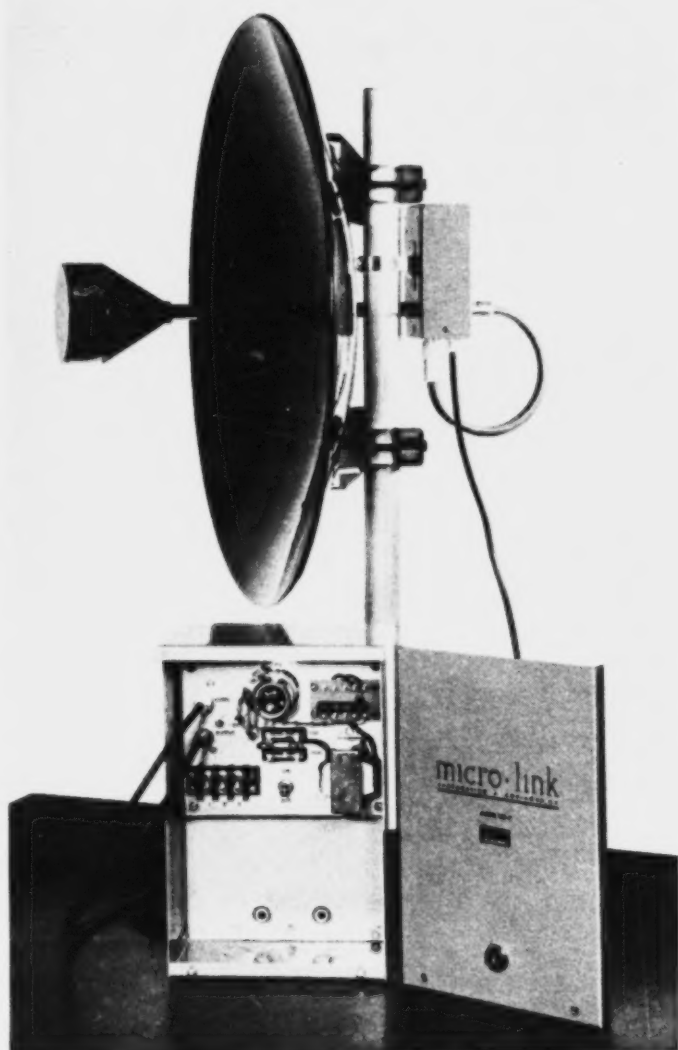
Installation

As stated previously, the first five steps shown on the chart must proceed in the sequence shown leading up to the granting of a Construction Permit. The forming of contracts and the beginning of installation are somewhat independent but related to the five step sequence. The FCC regulations do not permit the starting of installation prior to the granting of the Construction Permit, and the permit requires that construction begin in 60 days and be completed in six months. As stated above, contracts must be formed in sufficient time to allow the contractor to prepare equipment, form subcontracts, and the like. The chart shows the shortest possible time for completion of a project; that is, the case in which the contract is formed at the earliest possible time in order that installation can begin as soon as the Construction Permit is issued. Later formation of contracts would, of course, mean later completion than shown in the chart.

Summary

The time schedule shown in the charts and accompanying remarks are a simplified situation and demonstrate the minimum time in which it can be realistically expected that a system could be in operation. No consideration has been given to the funding aspect; this is assumed as already provided. It is also based on an element of risk in forming contracts prior to issuance of the Construction Permit. It is shown that a period of three to five months to accomplish the steps is necessary to

MODEL #CE-5 RECEIVING CONVERTER



The Model #CE-5 Instructional Television Receiving Converters are designed to provide "state of the art" reception at minimum cost. With suitable channel assignments, the converter can receive up to five alternately spaced channels without objectionable interference. Actual field usage has exceeded the design reliability goal of an average ten year interval between repairs. The photograph illustrates a typical installation showing mast-mounted CE-5 Converter and AE-2 Antenna. The associated Power Supply is shown in foreground.

TECHNICAL SPECIFICATIONS

Input Frequency Range:	2500 to 2686 mc/sec
Output Frequency:	168 to 222 mc/sec
Power Gain:	18 db typical, 16 db minimum
Passband Ripple:	Within 2 db across passband
Noise Figure:	8.5 db typical, 10.5 db maximum
Input Impedance:	50 ohms
Output Impedance:	75 ohms
Frequency Stability:	.005% or better obtained through crystal control
Maximum Input Level:	-35 dbm (4 millivolts) for 1% intermodulation (five channels)
Reliability:	Completely solid state circuitry
Operating Temperature:	-40 to +140°F
Mechanical Construction:	Two piece construction consists of antenna mast-mounted converter and associated indoor mounted power supply. Converter completely weatherproof, light weight and provided with necessary mounting hardware. Single coaxial cable supplies power and transmission of converted signal.

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receive a Construction Permit. If the conservative approach is taken and contracts are not formed until the permit is obtained, then it will take five to nine months to put a system in operation. Another simplification is that this analysis has been based primarily on the microwave equipment. In the case of a complete new system including studio, receivers and distribution equipment, the added complexity will require even more precise project management.

As a typical example, suppose that a public school district wishes to install a simple system in time for operation at the beginning of the school year, September 1st. Assuming that the fiscal year begins on July 1st, this date would be none too soon to allow the contractor time to complete the work. This means that plans should be made to obtain a Construction Permit in June. Since FCC Form 330P requires information about the specific equipment to be used, the school district must select a contractor in mid-April for timely submission of the application. Initial planning and estimating should, therefore, start in January or February at the latest.

Each ITV system is somewhat unique, with its own set of problems. For professional assistance in planning an ITV project, an inquiry directed to Micro-Link Corporation will receive prompt response.



13 db gain Yagi 2500 megacycle receiving antenna,
including converter and power supply.
(ANOTHER STATE OF THE ART ADVANCE BY MICRO-LINK)